

Unit 1 Day 4

Section 1.6

Rational Exponents

## Definitions and Rules for Exponents

Let  $r$  and  $s$  be rational numbers. The results here are valid for all positive numbers  $a$  and  $b$ .

$a^r \cdot a^s = a^{r+s}$	$(ab)^r = a^r \cdot b^r$	$(a^r)^s = a^{rs}$
$\frac{a^r}{a^s} = a^{r-s}$	$\left(\frac{a}{b}\right)^r = \frac{a^r}{b^r}$	$a^{-r} = \frac{1}{a^r}$

$$a^0 = 1$$

$$2xy^0 = 2x$$

## Rational Exponent

For all integers  $m$  , all positive integers  $n$  , and all real numbers  $a$  for which  $a^{1/n}$  is a real number:

$$a^{m/n} = \left(a^{1/n}\right)^m .$$

Perform each operation mentally.

$$1) \quad \frac{3.3^3}{1.1^3} = 3^3 = 27 \quad 2) \quad (.25^2)(44^2)$$

$11^2$   
 $121$

If  $x^2 = 20$  , what is  $x^6$  ?

$$\downarrow$$
$$(x^2)^3 = (20)^3$$

$$x^6 = 8000$$

Simplify using the rules of exponents (only positive exponents)

1)  $\left(x^{\frac{3}{2}}y^{\frac{1}{5}}\right)^{10}$

$x^{\frac{3}{2} \cdot 10} y^{\frac{1}{5} \cdot 10}$

$x^{15} y^2$

2)  $(y^{z+2})^4$

$y^{4(z+2)}$

$y^{4z+8}$

$4z+8 < 0$   
 $4z < -8$   
 $z < -2$

$\boxed{y^{4z+8} \quad z \geq -2}$

$\boxed{\frac{1}{y^{-4z-8}} \quad z < -2}$

$$3) \frac{(x-1)^5}{(x-1)^3}$$

$$(x-1)^2$$

$$x^2 - 2x + 1$$

$$4) \left( \frac{4xy^5z^2}{x^{-2}yz^3} \right)^{\frac{1}{2}}$$

$$\left( \frac{4x^3y^4}{z} \right)^{\frac{1}{2}}$$

$$\frac{4^{\frac{1}{2}} x^{\frac{3}{2}} y^2}{z^{\frac{1}{2}}} = \frac{2x^{\frac{3}{2}}y}{z^{\frac{1}{2}}}$$

$$5) \frac{2^{\frac{1}{4}} \cdot 2^{\frac{5}{4}}}{2^4} = \frac{2^{\frac{3}{2}}}{2^4}$$

$$2^{\frac{3}{2} - \frac{8}{2}}$$

$$2^{-\frac{5}{2}} = \frac{1}{2^{5/2}}$$

$$\frac{1}{4} + \frac{5}{4} = \frac{6}{4}$$

$$6) \frac{(x^3)^{y+2}}{2x^y}$$

where  $y < -3$

$$\frac{x^{3-y-2}}{2(x^{3-y-2})}$$

$$\frac{x^{-y}}{2x^{-3y-6}} = \frac{x^{2y+6}}{2}$$

$$-y - (-3y - 6) = -y + 3y + 6$$



Simplify using the rules of exponents (only positive exponents - AKA write final answer with only positive exponents)

6) AGAIN

$$\frac{(x^3)^{y+2}}{2x^y} \quad \text{where } y < -3$$

$$\frac{x^{3y+6}}{2x^y} = \frac{\cancel{x}^{2y+6}}{2} = \frac{1}{2x^{-2y-6}}$$

$$\begin{aligned} 2y+6 &< 0 \\ 2y &< -6 \\ y &< -3 \end{aligned}$$

7)  $\frac{(x^3)^{y+2}}{2x^y}$  where  $y > 0$

$$\frac{x^{3y+6}}{2x^y} = \frac{x^{2y+6}}{2}$$

8)  $\left( \frac{x^{14}(x^5)^{-9}}{(2x^7)^2} \right)^{-\frac{1}{7}} =$

$$\left( \frac{\cancel{x^{14}} \cancel{x^{-45}}}{4 \cancel{x^{14}}} \right)^{-\frac{1}{7}} =$$

$$\frac{x^{45/7}}{4}$$

9)

$$\frac{(3m^3)^2 (mn)^{-1}}{(25m^{14}n^{-4})^{\frac{1}{2}}} = \frac{9m^6 \cdot m^{-1}n^{-1}}{5m^7n^{-2}}$$

$$= \frac{9m^{5-1}n^{-1}}{5m^7n^{-2}}$$

$$= \frac{9n}{5m^2}$$

10)

$$\left[ \left( \frac{1}{4}x^{-4}y \right)^{-2} \left( -\frac{1}{2}xy^5 \right)^2 \right]^3 =$$



Homework:

Day 4 Assignments

pg 36: 95-98,

pg 61: 29-52,

pg 63-64: 97-100 all